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A system of innovation to activate practices on open data: The Open4Citizens project

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Abstract. The increasing production of data is encouraging government institutions to consider the potential of open data as a public resource and to publish a large number of public datasets. This is configuring a new scenario in which open data are likely to play an important role for democracy and transparency and for new innovation possibilities, in relation to the creation of a new generation of public services based on open data.

In this context, though, it is possible to observe an asymmetry between the supply side of open data and the demand side. While more and more institutions are producing and publishing data, there is no public awareness of the way in which such data can be used, nor is there a diffuse practice to work with those data.

The definition of a practice for a large use of data is the aim of the Open4Citizens project, which promoted initiatives at different levels: at the level of immediate interaction between citizens, experts and open data, at the level of the creation of an ecosystem to work with data and at a level that could support the institutionalisation and consolidation of the new practice.

Keywords: Open Data, Innovation, Citizens participation.

1 Introduction

The increasing number of government initiatives for the publication of open data is generating an important information resource, which is also incremented by a technological trend that multiplies the number of devices that are recording different aspects of human life, natural environments or urban contexts [1,2]. Since 2009, when President Obama issued the first executive order to publish all the government information that does not need to be kept secret, a number of government initiatives have started in USA, followed by UK, Kenia, India, Singapore, Mexico, Russia and Europe [3,4].

The aim of such a large diffusion of initiatives was to increase the government transparency (citizens access to government data), to support service development by third parties (typically the smart city approach) and to develop a new generation of services that stimulate the economy [4,5].

The increasing relevance of open data as a resource for innovation immediately showed the potential for improving the quality of services offered to citizens in their

everyday life: services that could facilitate wayfinding, shopping, transportation or healthy habits. Innovation in such aspects could in turn generate a larger innovation system involving local business, public administrations, organisations or interest groups [6].

The present situation, though, is characterised by an asymmetry between the supply side and the demand side. The policies for opening data have been focusing on the implementation of the datasets repositories, rather than on the re-use of them, whereas the long-term demand-side still needs to be adequately stimulated. This is mainly due to a) the lack of a consistent framework to orchestrate and assess strategic interventions to shape an open data ecosystem [4] and b) the absence of a consolidated practice - and a community of practice - that exchanges knowledge and experiences while working with open data [7].

An open data ecosystem includes a range of activities, not only related to the release and publication of open data sets, but also to the treatment and the interpretation of these data, all the way up to the development of pathways showing directions for the usage of open data [6]. Of course, an ecosystem should also be defined by the actors, and the political and organisational infrastructure promoting or participating to those activities.

The activation of such an ecosystem would, in fact, be the basis for a profitable use of open data; however, the activation of such resource would also need a system of innovation [3]. In other words, making data fluid and available is a necessary but not sufficient condition to activate this resource; a learning process needs to be started, which increases the awareness of the opportunities offered by open data. An exploration is needed among citizens, government agencies, private stakeholders and other actors, in order to deeply understand the potential of this resource.

Kapoor et al. [3] observe that in the current paradigm the exploration of the potential and the value realisation is left to civic hackers, developers, small business and entrepreneurs. This is a limitation in the definition of the problem space: these actors are in fact the solution owners, i.e. the people that are most able to generate technical applications using open data, but they often lack an overview of the issues they are trying to address. The inclusion of problem owners - i.e. citizens, public administrators and interest groups that have a clear view of critical problems to solve - would instead call for an open and broader process, based on participation and co-creation.

Given those premises, in order to support the use of open data, Kapoor et al. propose a structured system of innovation, consisting in three subsystems:

- A system of records, including datasets and the treatment needed to make data usable;
- A system of insights, including tools, algorithms and APIs, which would allow for data to be visualised or used in apps and services;
- A system of engagement that would generate social and collaborative capabilities.

The construction of such system would make it possible to support an innovation process that would involve social actors that are usually unfamiliar with open data and unaware of their potential. The creation of a community of practice should consist of a learning-by-doing process, which means that learning a practice of working with

data is possible through a real involvement of a community in the creation of solutions at different technology readiness levels, from concepts to operating services. According to Wenger [8], a community of practice is a community of people that engage in a shared process of collective learning within a shared domain. Their involvement is not necessarily intentional, that means that it is unlikely that people will come together to learn how to use open data, but they will possibly join their efforts and spend their energy to solve cogent problems related to their community.

The Open4Citizens project is a good exemplification of this innovation ecosystem. The project is, indeed, generating the elements of the subsystems described by [3] as it includes a data repository (a platform), a system of insights (perspectives and inspiration on how to use data) and a system of engagement (hackathons). This paper will look at Open4Citizens as a system of innovation, particularly focusing on how this system supported learning processes and strengthened the relation of citizens and other actors regarding the access to and use of open data.

2 The Open4Citizens project

Open4Citizens (O4C) is a European project supported by a funding scheme oriented toward Cooperative Awareness Platforms for Sustainability and Social Innovation (CAPSSI).

The project, started in 2016, is generating opportunities for citizens, interest groups, municipalities and local businesses to get better insights, inspiration or support to develop projects based on the use of open data.

The genesis of the project started from the concept of hackathons as co-creation and participatory processes. Traditionally, hackathons are a well-known strategy to accelerate innovation, by grouping IT experts in a “pressure cooker” event, which in few intense days can produce innovative solutions [9].

The presence of IT experts in hackathons is giving a relatively high certainty to develop interesting solutions; the absence of possible users of the hackathons’ outcomes, however, also implies an equally high possibility that such solutions do not match real and concrete problems. This motivates the O4C team’s idea to extend the participation to their hackathons and involve actors with different knowledge and expertise, in the perspective to engage problem and solution holders in an intense co-creative process. The involvement of citizens and other relevant stakeholders in activities that use open data is also a way to activate a process of learning-by-doing, in which such stakeholders will be able to figure out the full potential of open data by participating in the creation of a new generation of public services.

This strategy, though, changes the whole conception of hackathons and their organisation. Especially in the early days, hackathons were self-organized gatherings, where a group of people (typically, IT experts) would meet for 24 or 48 hours and work on issues of common concern. The organization of such early hackathons was quite loose and spontaneous [9]. Conversely, the hackathons of O4C required a long preparation process, which is needed to make sure that an ecosystem of relevant actors is gathered in the hackathon event: this means a long preparatory work before the hackathon and a post-hack process (Figure 1).

The hackathon event is obviously still the central part of this process: like in the format of the previous hackathons, the O4C events consist of two or three days intense working time, in which participants are collaborating in groups, with periodic presentation of their progress at the end of each day. The final presentation usually includes a review by an invited jury, which often selects a group to be granted with an award. The presence of non-IT-skilled people requires that these events have to be accurately planned and facilitated, also using inspiration tools (e.g. inspiration cards showing possible uses of open data), templates (to map users needs and to outline service journeys), and specific tools and exercises to learn how to deal with data, like data cards (Figure 2). The O4C team collected these facilitation tools in a preliminary hackathon starter kit and in a Citizens' hackathon toolkit.

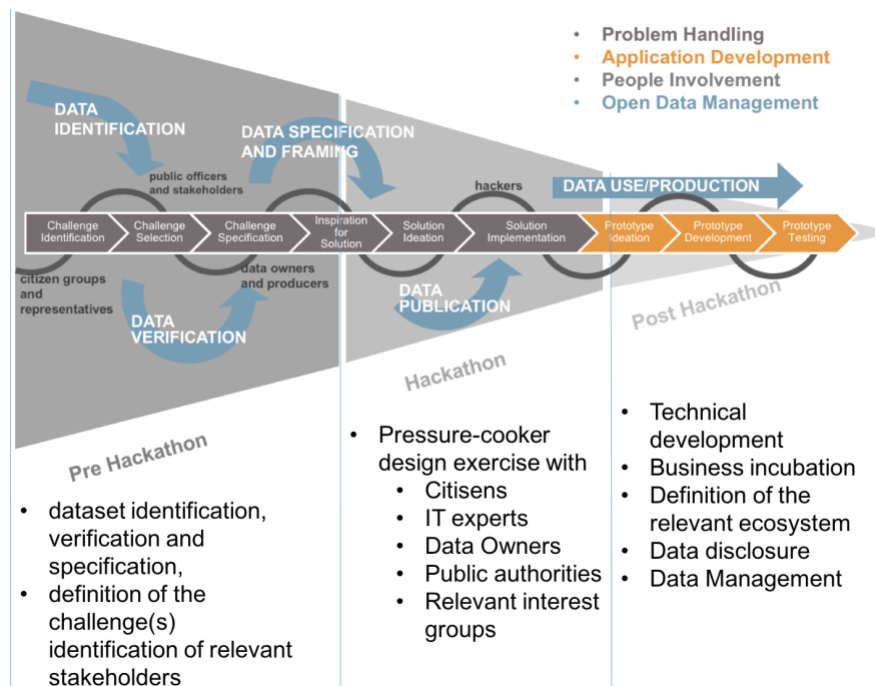


Fig. 1. The O4C hackathon process.

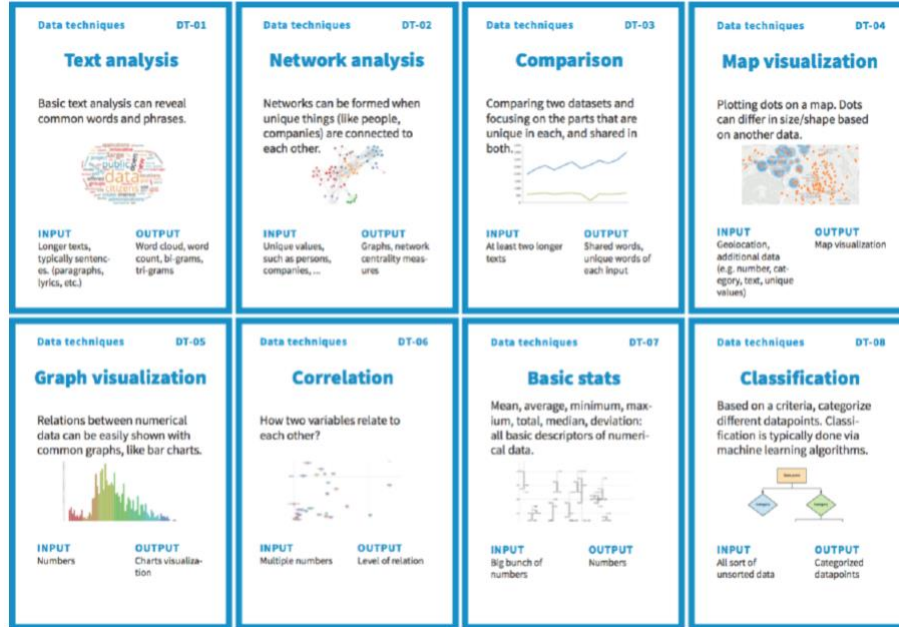


Fig. 2. Data cards are a tool for the hackathon participants to understand open data, figure out techniques to work with them and negotiate a practice in a group of hackathon participants [10].

Finally, the post-hack phase is the phase in which the hackathon outcomes are tested, incubated and validated. This phase includes an intense process of incubation, development and integration of the hackathon's outcome into the existing administrative, technical and economic systems that constitute public services. This part of the hackathon process implies intersections with political, business related and technical issues, that often obstruct the innovation process, but sometimes accelerate it. The success in this phase very much depends on the presence of key actors in the hackathon ecosystem that have promoted and followed the process.

3 The outcome of the Open4Citizens project

The work on the hackathon events and on the whole hackathon cycle highlights the need to organise the innovation process on open data around an ecosystem that collects the relevant stakeholders in relation to a process and create compressed and accelerated innovation sessions.

At the same time, it is important to make sure that the knowledge acquired in the organisation of such innovation sessions is consolidated in an infrastructure that would make the hackathon experience reproducible and facilitate the public access to data. The project team defined this infrastructure as an OpenDataLab, i.e. a virtual platform and possibly a physical reference point for open data use and diffusion. The

research effort of O4C is therefore concentrated on different perspectives, as in a matrioshka (Figure 3):

- the hackathon event, i.e. a “pressure cooker” innovation process, of the duration of 2-3 days;
- the hackathon process, i.e. a process of 6-7 months that gathers the fundamental components of an open data ecosystem in respect to a specific problem area;
- An OpenDataLab, i.e. a permanent innovation place, where citizens can learn about open data, even outside the hackathon process.

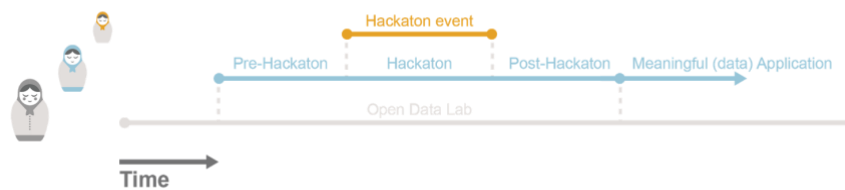


Fig. 3. The "matrioshka" model defines three logical levels in the process of activating the use of open data [10]

Those three levels also represent a progressive extension of the community of practice [8] around open data from IT experts to a broader community of citizens, public administrators, interest groups and small business. The hackathon is one of the most common practice to generate fast innovation processes within the community of IT experts and coders. Another way of looking at this matrioshka model for O4C is as a progressive learning process where the various actors learn how to use open data and where the practice of using open data is activated.

Opening the hackathon event to a broader social context requires a process that defines an ecosystem of actors, tools and new practices. The hackathon process is aimed at defining a balanced interaction of three elements:

- **People:** the process has to make sure that the relevant people are present in the hackathon, which may play a role in the development of a solution. Among them, it is important to involve the relevant issue owners, such as public administrators that are looking for innovative public services, or even data owners, which are often unaware of the potential of the datasets they own or are eager to give value to those data as a resource for innovation.
- **Data:** the hackathon process should make sure that relevant data are collected before the hackathon, in order to offer the participants the raw material to work on during the hackathon event.
- **Challenges:** the process of creating a new practice is only possible if the participants are genuinely involved in the solution of concrete problems. This means that relevant challenges have to be proposed, for which the participants will be willing to spend their energy and time. The choice of the challenge often refers to urgent political issues, social emergencies or organisational issues.

Finally, the OpenDataLabs represent a consolidation and institutionalisation of the new practice. In the O4C view, they are public innovation places [11] that support the dissemination of a culture of open data, offer services (e.g. consultancies, facilitation for hackathons, working tools) for those who want to use open data, and actively promote any initiative for the use of this resource. In other terms, they are learning spaces where a variety of actors can gather and explore the potential and challenges of open data. The initial inspiration for the OpenDataLab comes from maker spaces: besides being public spaces where people are able to manipulate material to generate innovative solutions, maker spaces are also places to exchange knowledge and disseminate a practice of digital fabrication. Likewise, OpenDataLabs are supposed to play the same social and institutional role when manipulating open data.

In consideration to Kapoor's elements for an innovation system [3], the effort of the O4C team consisted in identifying such elements at the three levels mentioned above. This defines a systemic strategy for supporting the generation of new practices at all levels (Table 1). It is worth noticing that the extension of the focus from the technical treatment of open data to the social context requires a broader interpretation of Kapoor's terms, to include social and practical issues related to the participation to the hackathon event, the hackathon process and the activities in the OpenDataLab.

Table 1. Elements of the innovation ecosystems at the three levels of the O4C project.

	System of records	System of insights	System of engagement
Hackathon event	Datasets, data repositories	Visualisation and inspiration tools	Hackathon and workshop facilitation, data sprints. Involving data owners and issue owners
Hackathon process	Shared issues, community culture and attitudes, institutional settings	Activities focused on data, people and challenges	Hackathon event, Participatory activities
OpenDataLab	Knowledge about open data	Calls for projects, call for data, fundraising, navigation and visualisation support	Activities that engage citizens, public administrators, data owners and other relevant stakeholders

3.1 The hackathon event level

The system of records at the hackathon level consists in the collection of all the raw material for the hackathon activity. The raw material for a creative activity on open

data is, of course, a number of datasets: links to the most relevant data repositories were collected for the participants before the hackathon event.

The system of insights in the hackathon event consists of the visualisation and inspiration tools provided to the participants. This includes inspiration cards, examples and visualisations of existing datasets.

The system of engagement consists of the various tools and strategies for engaging participants, including facilitation or data sprints. It is worth noticing that the engagement of participants also depends on non-technical issues, such as the participation of data owners or issue owners (e.g. public administrations proposing a problem to solve or awards for the best project).

3.2 The hackathon process level

The raw material in the hackathon process consists of the information coming from institutional, social and organisational frameworks. It includes shared issues, community culture and attitudes, institutional settings, including laws, hierarchical structures and regulations. In other words, the raw material for the hackathon process is the social, technical and organisational ecosystem in which certain problem areas can be addressed with the use of open data.

The system of insights in the hackathon process consists of the activities that are supporting the formation of the hackathon ecosystem, they include activities focused on the three main components of the hackathons: challenges (What are the relevant problems that the hackathon should solve?), data (Which datasets can be relevant? Which ones are available? Which ones can be found from different sources?) and people (Who are the people that would be motivated to solve the challenges?)

Finally, the system of engagement consists of the participatory activities during the hackathon process, including the hackathon event and a number of other preparatory or post-hack events, including data sprints, service jams, meetings and workshops.

3.3 The OpenDataLab

The raw material collected in the OpenDataLabs is the whole knowledge around open data, that means: an archive of datasets, applications, inspiration and networking tools that would make it possible for any user of the Lab to use data, work with data or get information on how to use open data.

The OpenDataLabs are also supposed to collect and support activities on open data, such as calls for projects, calls for data and fundraising opportunities, data navigation and visualisation support. All these elements are part of the system of insights related to the OpenDataLab.

The number of activities that engage citizens, public administrators, data owners and other relevant stakeholders in open-data-related processes represents instead the system of engagement in the OpenDataLab.

4 Discussion

The creation of a practice of designing with open data is a process of social construction that has an important learning dimension and that aggregates an ecosystem of people, technologies, data, institutions, and challenges. The hackathon is certainly an effective tool to support such a process, especially if it is based on the construction of the ecosystem in the pre-hack phase and followed by a solid support to the development of the outcomes in the post-hack phase. This temporal articulation (pre-hack, hackathon and post-hack phases) goes beyond the typical duration of such events (24-48 hours [9]). The hackathon per se is an accelerated and compressed learning process that works very well to raise the awareness of the potential of open data, but is often not sufficient to consolidate the process of learning that the generation of a practice would need. A logical tension emerges, between the quick and intense process in the hackathon and what takes for normal citizens to get acquainted with data tools and methods.

This makes the extended temporal articulation of the O4C hackathon processes and, in particular, the OpenDataLab more relevant for the creation of a practice of working with data. The matrioshka model for O4C is a progressive learning process that culminates with the OpenDataLab as a more stable learning space where various actors can tinker with data, data visualisation processes and data handling tools and can experiment with related facilitation and organisational capabilities. In other words, the OpenDataLab would be fundamental for the institutionalisation of a practice around open data. In this sense, OpenDataLabs can be seen as public innovation places [11] for the consolidation of such practice.

The three levels mentioned in this paper are, therefore, configuring a complex structure that invests different aspects of the construction of a practice. The hackathon event is the moment in which interaction and co-creation happen. It is the level of effective participation of multiple stakeholders, such as citizens, public authorities, interest groups, data owners and business companies. It is sometimes a highly emotional event, because of the intense and concentrated work it requires. The event is generating awareness, opening perspectives, introducing to new tools, creating short circuits among actors that would otherwise never have a chance to meet or work together. All the participants to the hackathon event have an opportunity to get closer to a practice of working with open data, although the event per se is too short to create consolidated knowledge.

The hackathon process is dedicated to the construction of an ecosystem. It is a moment of intense negotiation between different stakeholders, organisations and institutions. This is a process of definition of the challenges and identification of relevant datasets. What the stakeholders of this process learn in this period is to recognise the relevant players related to specific challenges and specific datasets. The learning process concerns systemic aspects of working with open data.

Finally, the OpenDataLab represents the consolidation of knowledge, the creation of a shared pool of skills, capabilities and opportunities in a community, the creation of knowledge that can influence the institutional framework, public policies and governance of open data.

The O4C team intends to propose OpenDataLabs as a seed for a movement of democratisation of open data, getting inspiration from the FabLab movement. In the

last decade, FabLabs, maker spaces and personal fabrication labs have created a new culture and practice of production, which is opening new perspectives for material production and is promising to democratise the access to production resources, including the creation and support of commons [12,13]. This movement, as well as the OpenDataLabs, in the intention of the O4C team, will create new institutional frameworks for the production of material goods and services for citizens. Within this perspective, open data can be considered as new commons [14,15].

5 Conclusion

This paper used the construct of system of innovation to look at the Open4Citizens project and, in particular, focused on how this system supported learning processes and strengthened the relation of citizens and other actors with regard to the access to and use of open data.

The potential of open data to become a resource for society has been quite clearly perceived by governments and organisations. However, there is a lack of distributed awareness of how to use this resource. Citizens, public authorities and institutions still do not know what to do with open data and how to work with them. While the supply side becomes more and more relevant with the creation and distribution of new datasets in many areas, the demand side is still underdeveloped. While the practice of analysing and exploring data is maturing, thus creating systems of insights [3] in the private and public sector [16], the last step in the learning process that would activate open data as a commons is still far from being done: there is no culture of designing with data, and no practice of dealing with it and, therefore, the system of engagement [3] that would activate open data as a resource is still to be developed.

The Open4Citizens project illustrated in this paper is proposing a strategy to close this gap. The system of innovation illustrated in this paper is an attempt to implement a structured learning process (pre-hack, hackathons, post-hack with OpenDataLabs) to build a community and to activate a practice that does not yet exist.

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